

Application Serial No.:
10/607,251

Attorney Docket No.:
SP02-142

Amendments to the claims

1. *(Previously Presented)* A regenerable sorbent for removing trace amounts of oxygen from either a gas-stream or a closed system, the sorbent comprises:
a mixed-oxide material composed by weight of about 1% to about 99% Ce_2O_3 , about 0% to about 99% ZrO_2 , and 0% to about 25% R_xO_y , wherein R_xO_y is another metal oxide, and x and y are integers; and
at least one of the following transition metals: Fe, Co, Ni, Cu, Ru, Pd, Rh, Pt, Ir, Os, or their oxides or mixtures thereof in catalytic amount of 0% to about 10 %, on a surface of said mixed oxide material.
2. *(Previously Presented)* The sorbent according to claim 1, wherein said cerium oxide content ranges from about 20% to about 95% by weight.
3. *(Previously Presented)* The sorbent according to claim 1, wherein said zirconium oxide content is 5-80% by weight.
4. *(Previously Presented)* The sorbent according to claim 3, said zirconium oxide content is about 40-50% by weight.
5. *(Previously Presented)* The sorbent according to claim 1, wherein said mixed-oxide material is of a single-phase metastable matrix.
6. *(Previously Presented)* The sorbent according to claim 1, wherein said R_xO_y is a transition metal or rare earth metal oxide.
7. *(Previously Presented)* The sorbent according to claim 5, wherein said R_xO_y is Y_2O_3 , Sc_2O_3 , Nd_2O_3 , or Sm_2O_3 .
8. *(Previously Presented)* The sorbent according to claim 1, wherein said transition metals and oxides thereof are of either Pd, Rh, Pt, Ir or a combination thereof in an amount of about 0.01 to 5% by weight.

Application Serial No.:
10/607,251

Attorney Docket No.:
SP02-142

9. *(Previously Presented)* The sorbent according to claim 1, wherein said mixed oxide material has a surface area ranging from about $0.1 \text{ m}^2/\text{g}$ to about $150 \text{ m}^2/\text{g}$.
10. *(Previously Presented)* The sorbent according to claim 1, wherein said mixed oxide material has a crystal size ranging from about 1 nm to about 100 microns.
11. *(Previously Presented)* The sorbent according to claim 8, wherein said mixed oxide material has a crystal size ranging from about 4 nm to 90 microns.
12. *(Currently Amended)* The sorbent according to claim 1, wherein said sorbent can operate in a wide range of temperatures, from about -40°C up to about 1200°C .
13. *(Currently Amended)* The sorbent according to claim 1, wherein said sorbent can operate in a temperature range from about 0°C or ambient room temperature (-20°C) to about 1000°C .
14. *(Previously Presented)* The sorbent according to claim 1, wherein said material has additional capacity to take up any oxygen that may seep through hermetical seals into an enclosed environment or container.
15. *(Previously Presented)* The sorbent according to claim 1, wherein after complete reduction of said material, the oxygen sorption capacity is at least 2 times greater than conventional sorbents per volume.
16. *(Previously Presented)* The sorbent according to claim 1, wherein the oxygen capacity is about 10-15 ml per gram.
17. *(Previously Presented)* The sorbent according to claim 1, wherein said sorbent can operate in noxious environments, which would otherwise poison conventional catalysts.

Application Serial No.:
10/607,251

Attorney Docket No.:
SP02-142

18. *(Previously Presented)* A method of preparing an oxygen sorbent, the method comprising:
- preparing a mixture of mixed-oxide compounds;
 - precipitating a mixed metal hydroxide with a concentrated base solution of mixed bases, from said mixed-oxide mixture;
 - collecting said hydroxide precipitate and washing with a liquid-phase solvent;
 - calcinating said hydroxide precipitate to a mixed-oxide material in flowing air.
19. *(Previously Presented)* The method according to claim 18, the method further comprising impregnating metal or metal oxides on and in said mixed-oxide material; and activating said hydroxide precipitate or mixed oxide material.
20. *(Previously Presented)* The method according to claim 18, wherein a single-phase mixed oxide matrix of ceria and zirconia is produced, having a ceria content of up to about 95 mole %.
21. *(Previously Presented)* The method according to claim 20, wherein said ceria content in said mixed-oxide material is about 50-80 mole %.
22. *(Previously Presented)* The method according to claim 20, wherein said single-phase material is of a metastable mixed-oxide matrix.
23. *(Previously Presented)* The method according to claim 19, wherein said metal or metal oxides are of transition or precious metals, including at least one of the following: Fe, Co, Ni, Cu, Ru, Pd, Rh, Pt, Ir, Os, or their oxides or mixtures thereof in catalytic amount of 0% to about 10 %.
24. *(Previously Presented)* The method according to claim 19, wherein said activating step is a reduction of said hydroxide precipitate or mixed-oxide material.
25. *(Previously Presented)* The method according to claim 18, wherein said mixture of mixed-oxide compounds includes an aqueous medium of at least a soluble cerium compound and at least a soluble zirconium compound.

Application Serial No.:
10/607,251

Attorney Docket No.:
SP02-142

26. *(Previously Presented)* The method according to claim 25, wherein said mixed-oxide compounds include soluble cerium (III) or cerium (IV) salts, or soluble zirconium salts.
27. *(Previously Presented)* The method according to claim 18, wherein said mixed-oxide mixture is incorporated into said base solution.
28. *(Previously Presented)* The method according to claim 18, wherein said base is ammonium hydroxide.
29. *(Previously Presented)* The method according to claim 18, wherein said base concentration ranges from about 1M/L to 16 M/L.
30. *(Previously Presented)* The method according to claim 29, wherein said base concentration ranges from about 4M/L to 8 M/L.
31. *(Previously Presented)* The method according to claim 18, wherein said liquid-phase solvent is a dehydrating agent.
32. *(Previously Presented)* The method according to claim 31, wherein said liquid-phase solvent is an alcohol.
33. *(Previously Presented)* The method according to claim 32, wherein said liquid-phase solvent is ethanol.
34. *(Previously Presented)* The method according to claim 18, wherein said hydroxide precipitate is washed for 2 to 6 cycles.
- 35-77. *(Canceled)*
78. *(New)* The method according to claim 19, wherein said activating step is by means of reduction at about 400°C for about 4 hours.

Application Serial No.:
10/607,251

Attorney Docket No.:
SP02-142

79. (New) The method according to claim 78, wherein said activating step uses hydrogen, carbon monoxide, hydrocarbon vapor, or other reducing agents.
80. (New) The method according to claim 18, wherein step d) occurs at a temperature between about 250°C to about 600°C.
81. (New) The method according to claim 80, wherein said calcinating step occurs at a temperature between about 400°C to about 500°C.
82. (New) The method according to claim 18, wherein said calcinating step occurs for about 1-10 hours.
83. (New) The method according to claim 82, wherein said calcinating step occurs for about 4 hours.
84. (New) The method according to claim 18, wherein said sorbent can operate in noxious environments, which would otherwise poison conventional catalysts.